Identification of Male Sterility Maintainer and Fertility Restorer Lines from Iranian Landraces and Improved Cultivars of Rice (*Oryza sativa* L.)

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ABSTRACT

Afkhami Ghad, A., Khademian, R., Nematzadeh, G. A., Babaeian Jelodar, N. A., and Bagheri, N. A., 2019. Identification of male sterility maintainer and fertility restorer lines from Iranian landraces and improved cultivars of rice (*Oryza sativa* L.**). Seed and Plant Improvement Journal 35-1: 121-137.**

Identification of suitable restorer lines is one of the main priorities of hybrid rice production technology, followed by the production of local male sterile lines. To study fertility genetic capacity of 14 landraces, improved and foreign rice varieties, a test cross scheme was conducted using Neda-A male sterile line as female parent for the production of F_1s in 2018 at Genetic and Agricultural Biotechnology Institute of Tabarestan, Sari Agricultural and Natural Recourses Sciences University, Sari, Iran. At the flowering stage, the sterility and fertility of pollen grains were tested using IKI solution. At the physiological maturity stage of F_1s agronomic traits such as days to 50% flowering, days to physiological maturity, plant height, number of fertile tillers, panicle length, number of grain per panicle, grain length, grain width, 100 grain weight, grain length: width ratio, panicle fertility percentage and grain yield were measured and recorded. The results of pollen grain and panicle tests of hybrids showed that the hybrid derived from Shiroodi × Neda-A hybrid had 100% sterility indicating that this variety is a maintainer, in other words, it carries normal cytoplasm and *rf*-induced nuclear gene. Given the larger cultivated areas of cv. Shiroodi and its earlier maturity than Neda variety, it is concluded that cv. Shiroodi would be more suitable for hybrid rice seed production. Therefore, Shiroodi-A line can be developed through backcrossing. The highest grain number per panicle (217 grain) was obtained from hybrid CB06-550. The highest 100 grain weight belonged to the hybrid Jahesh × Neda-A which is due to its larger grain size. By evaluating pollen and panicle test, Binam, Pardis and PR37181-1-1-2-1-2-1 varieties were identified as poor fertility restorer lines. IR50 and IR67924R lines with more than 96 and 80% fertility, respectively, were identified as strong fertility restorer lines. These sterile lines can be used to produce hybrid rice with higher yield than varieties developed through conventional breeding methods. Other lines developed in this study can be used in the development of hybrid technology in the rice heterotic gene pool.

Key words: Rice, sterility, grain number per panicle, 100 grain weight and genetic diversity.

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Comparison of Necrotrophic Behaviour and Electrolyte Leakage of Resistant and Tolerant Pear (*Pyrus communis* L.) Cultivars to Mutant Strains of Causal Agent of Fire Blight Disease under *In Vitro* Conditions

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ABSTRACT

Maleki, R., Abdollahi, H., and Piri, S. 2019. Comparison of necrotrophic behaviour and electrolyte leakage of resistant and tolerant pear (*Pyrus communis* L.) cultivars to mutant strains of causal agent of fire blight disease under *in vitro* conditions. **Seed and Plant Improvement Journal 35-1:** 139-154 (in Persian).

Response of pear cultivars to causal agent of fire blight diseases is expressed by both resistance and tolerance, however the difference of the two is not clear. To better understand the mechanisms of resistance and tolerance of pear cultivars to the disease, the necrotrophic behaviour and electrolyte leakage of resistant (Dargazi) and tolerant (Harrow Sweet) cultivars was compared with susceptible cultivar (Barttlet) after inoculation by wild type and mutant strains (*hrp*N$^-$, *dsp*A/E$^-$ and *hrp*W$^-$) of the bacterium. The appearance of symptoms in reaction to wild type strains occurred after three days in susceptible and tolerant cultivars, and in seven days in resistant cultivar. However, in resistant cultivar, Dargazi, disease progress slowed down. In all cultivars, one to two days before necrosis, electrolyte leakage increased to ~70%, and with the completion of necrosis it reached to 100%. The mutant strain *hrp*W$^-$ did not affect incidence of necrosis and electrolyte leakage, indicating no effect of this protein on resistance mechanisms. Using strain *hrp*N$^-$ increased the necrosis and electrolyte leakage in resistant cultivar and delayed these indices in tolerant cultivar in comparison with susceptible cultivar. Also, *dsp*A/E$^-$ strain accelerated necrosis and electrolyte leakage in resistant cultivar in comparison with tolerant cultivar, and had no symptoms on susceptible cultivar. Considering the dual role of *HrpN* in pathogencity and stimulation of host defense system, the results indicated key role of *HrpN* protein on acquired defense system (ADS) in relation to the pathogenic role in the resistant cultivar (Dargazi) and its inverse relationship in tolerant cultivar (Harrow Sweet). This dual behaviour can be used as a tool for deeper understanding of the fire blight resistance mechanisms in pear, and also as an index for distinctness of resistant and tolerant pear cultivars.

Key words: Pear, mutant strain, acquired defense system, resistance, tolerance.

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Pomological Characteristics and Fruit Yield of Some of Ilam Native Olive Genotypes Under Sarpol-e-Zahab Environmental Conditions

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ABSTRACT

Arji, I., Gholami, R., and Najafi, M. 2019. Pomological characteristics and fruit yield of some of Ilam native olive genotypes under Sarpol-e-Zahab environmental conditions. **Seed and Plant Improvement Journal 35-1:** 153-170 (in Persian).

Ilam is one of the rich olive germplasm resources in Iran. Identification and study of adaptation of native olive genotypes is of great importance for establishment of olive orchards. This research was carried out on 15 olive genotypes collected from Ilam province to evaluate pomological and fruit yield in comparison with cv. Amphissis as check cultivar from 2015 till 2018 at Sarpole-e-Zehab Olive Research Station, Sarpol-e-Zahab, Iran. The experimental design was randomized complete block with three replications. The results showed that pomological traits such as fruit, pit and flesh weight, flesh: pit ratio, fruit and pit dimensions were significantly different among genotypes. Fruit weight varied from 3.28 to 7.92 grams among olive genotypes. Fruit yield also differed among genotypes, BSCH2, BSCH3, SKE7, SKE8, BSCH1, DZ4 and SBM5 had higher fruit yield. Oil content in dry matter was significantly different among genotypes. Oil content in dry matter of NS3, SBM2, SBM1, SKE7, DZ4, PG3 and NS4 genotypes varied from 30-40%, and categorized as low oil olive genotypes. In general, results showed that BSCH2, BSCH3, SKE7, SKE8, BSCH1, DZ4 and SBM5 genotypes performed as promising genotypes with higher fruit yield at eight to nine years old trees and can be used for being released as new cultivars as well as establishing of new olive orchards.

Key words: Olive, adaptation, fruit characteristics, fruit yield, oil content.

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Response of Agronomic Characteristics and Seed Yield of Faba Bean (*Vicia faba* L.) Genotypes to Waterlogging Stress

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ABSTRACT

Mollaali, E., Dadashi, M. R., Sheikh, F., Ajam Norozi, H., and Feizbakhsh, M. T. 2019. Response of agronomic characteristics and seed yield of faba bean (*vicia faba* l.) genotypes to waterlogging stress. **Seed and Plant Improvement Journal 35-1:** 171-188 (in Persian).

Waterlogging stress is one of the important factors reducing faba bean seed yield. Response of different faba bean genotypes to this environmental stress varies from tolerance to sensitive. Response of agronomic characteristics and seed yield of 21 faba bean genotypes under three moisture regimes included; optimum irrigation (without stress) and waterlogging for 10 days at two developmental stages; commencement of flowering and pod setting were evaluated. This study was carried out using randomized complete block design with three replications in two cropping seasons (2016-2017 and 2017-2018) at Golestan agricultural and natural resources research and education center, Gorgan, Iran. Combined analysis of variance revealed that there was significant differences between faba bean genotypes in response to different moisture regime conditions. Green pod and seed yields were reduced by 34% and 23.9%, respectively, when waterlogging applied at the commencement of flowering stage. However, when waterlogging applied at pod setting stage these reductions were 29.3% and 17.18%, respectively. The lowest seed yield reduction belonged to G-Faba-401 genotype when stress applied at the flowering stage, and G-Faba-401, G-Faba-335, G-Faba-293, G-Faba-290 and G-Faba-524 genotypes showed less than 10% yield reduction. Therefore, the high-yielding and tolerant faba bean genotypes can be recommended for areas with high probability of waterlogging stress.

Key words: Faba bean, day to flowering, green pod yield, seed yield, 100 seed weight.

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Evaluation of Phenological Characteristics, Fruit Setting and Fruit Quality Properties of Some Plum Cultivars under Karaj Environmental Conditions

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ABSTRACT

Falati, Z., Fattahi Moghaddan, M. R., and Ebadi, A. 2019. Evaluation of phenological characteristics, fruit setting and fruit quality properties of some plum cultivars under Karaj environmental conditions. **Seed and Plant Improvement Journal 35-1:** 189-210 (in Persian).

Plums are important species among Prunus genus with significant role in fruit market and industry. This research was carried out to evaluate phenological characteristics, fruit setting and fruit quality traits of 16 plum cultivars in 2014 and 2015 growing seasons in horticultural research station of horticultural and landscaping engineering department of agricultural and natural resources campus of the University of Tehran. The results showed significant differences among plum cultivars for all traits. Cultivar Black Star and cv. Bukhara were early and late in respect of flowering, leaves appearance and ripening times in both years, respectively. Phenological characteristics of cultivars differed in two years as the commencement of blooming, full bloom and ripening time occurred earlier in the first year. Flowering period among examined plum cultivars was also different and longer in the first year. The abscission percentage of flower buds, flowers, fruitlets and fruits were different among cultivars. Cultivar Sugar and cv. Golden Drop had higher fruit set rate. Cultivar Black Star and cv. Shablon had the largest fruits, and Simka and Stanley cultivars had higher fruit firmness and fruit flavor index, respectively. Cultivars with desirable flowering time; cv. Bukhara, cv. Stanley and cv. Sugar, and also cultivars with high fruit yield potential; cv. Japanese, cv. Simka and cv. Shablon, can be used in plums breeding programs and establishing of new orchards.

Key words: Plum, flowering, flower abscission, fruitlet, fruit firmness, fruit flavor index.

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Genetic Diversity in Wild Ecotypes of Fenugreek (*Trigonella monantha* C. A. Mey.) Based on Morphological Traits

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ABSTRACT

Esmaeilnejad Hasaroeih, N., Ghanavati, F., Moradi, F., Abbasi Kohpalkani, J,, and Rahimizadeh, M. 2019. Genetic diversity in wild ecotypes of Fenugreek (*Trigonella monantha* C. A. Mey.) based on morphological traits. **Seed and Plant Improvement Journal 35-1:** 211-239 (in Persian).

To investigate genetic diversity using morphological traits and to determine the relationship between seed yield and its components, 40 *Trigonella monantha* ecotypes collected from different areas in Iran and are preserved in the National Plant Gene Bank of Iran were evaluated. The results showed significant differences ($P < 0.01$) among ecotypes for all the evaluated traits. Mean comparisons revealed that ecotype No. 1 (Lorestan-Azna1) was superior than the others for seed yield plant^{-1}, sub branch number plant^{-1}, number of leaves to the first flower, number of leaves plant^{-1}, 100-seed weight, petiole length, and leaflet width. There was significant and positive correlation between seed yield and number of branches plant^{-1}, number of leaves plant^{-1}, 100-seed weight, and number of pods plant^{-1}, petiole length, seed length, and seed width. Shannon index showed that pod shape, seed color, seed surface ornaments, pod distribution in the plant had high variability. Stepwise regression analysis indicated that 100-seed weight, number of pod plant^{-1}, petiole length and pod length had significant effects on the seed yield. Factor analysis using principle components method could extract nine factors that in total explained 75.66% of the total variance. Cluster analysis for quantitative and qualitative traits classified the ecotypes into four and five different groups, respectively. In conclusion, there is high genetic diversity in the wild ecotypes of *T. monantha* for the morphological traits which can be used in fenugreek breeding programs.

Key words: Fenugreek, quantitative traits, qualitative traits, leaf number plant^{-1}, 100 seed weight.

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Scientific Short Article

The Possibility of Using Iranian Asparagus (*Asparagus persicus*) in Breeding Programs

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ABSTRACT

Ranjbar, M. E., Ghahremani, Z., Mousavizadeh, S. J., Barzegar, T., and Gil, J. 2019. The possibility of using Iranian asparagus (*Asparagus persicus*) in breeding peograms. **Seed and Plant Improvement Journal 35-1:** 241-249 (in Persian).

Asparagus officinalis is the most economically important species of asparagus. *A. persicus* is known as Iranian asparagus among the wild species which can grow under harsh environmental conditions such as high temperature and saline and dry soils. Therefore, it can be a suitable germplasm for interspecific hybridization in asparagus breeding programs. The possibility of using *A. persicus* in breeding programs and also employing molecular markers to detect hybrid plants developed from hybridization between *A. persicus* and some other species of asparagus were investigated. Twenty one accessions of asparagus from diploid (2x) to dodecaploid (12x) from six different countries were used. Successful crosses were made for *A. officinalis* (2x) × *A. persicus* (2x) by hand pollination. Hybridization rate for *A. persicus* was 34.1%. AG8 primer could detect specific allele for *A. persicus*. TC6 primer is a suitable molecular marker to detect interspecific hybrid plants for *A. persicus* in open pollinated and controlled crosses. ACM101 primer that has been designed for onion could also be used to evaluate genetic polymorphism in different accessions of asparagus.

Key words: Iranian asparagus, interspecific hybridization, SSR markers and wild species.

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